

MICHIGAN ENVIRONMENTAL SCIENCE BOARD

HYDROGEN SULFIDE PANEL MEETING SUMMARY

**TUESDAY, MARCH 28, 2000
301 SOUTH CAPITOL AVENUE
HIGGINS ROOM
LANSING, MICHIGAN**

PANEL MEMBERS PRESENT

Dr. Lawrence Fischer, Chairman
Dr. John A. Gracki
Dr. David T. Long
Mr. Keith G. Harrison, Executive Director

DEQ/OSEP SUPPORT STAFF PRESENT

Mr. Jesse Harrold, Environmental Officer

I. CALL TO ORDER

Dr. Lawrence Fischer called the Michigan Environmental Science Board (MESB) Hydrogen Sulfide Panel (Panel) meeting to order at 9:00 am. He also indicated that Dr. George Wolff would not be in attendance.

II. EXECUTIVE DIRECTOR'S UPDATE

Mr. Keith Harrison indicated he had distributed to Panel members the report as it had been written to date, including background work on air issues that had been completed by Dr. Wolff. Also provided were inconclusive data on complaints in Michigan, and an update on the ongoing research at the Chemical Industry Institute of Toxicology (CIIT). Additionally, Panel members had received a copy of a 1999 journal, *Environmental Epidemiology and Toxicology* devoted to hydrogen sulfide issues including central nervous system dysfunction. Mr. Harrison stated that he had brought with him documents regarding three surveys of low level hydrogen sulfide exposure, which provided more background information. One survey was conducted on a mushroom farm in Pennsylvania in 1999, and the other two were conducted by the Agency for Toxic Substances and Disease Registry in 1997 and 1998. He indicated that while all three surveys were able to demonstrate a nuisance odor problem, none were able to demonstrate any adverse health effects. Mr. Harrison stated that the Michigan Department of Environmental Quality (MDEQ) has delayed finalizing its recommendations regarding rule changes that would address low level hydrogen sulfide exposure until the Panel completes its report.

III. PANEL DISCUSSION

Dr. Fischer asked if anyone had any additional input regarding exposure to low level hydrogen sulfide in Michigan. Mr. Frank Mortal (Michigan Oil and Gas Association,

Lansing) noted that there has been no new incidents or ongoing problems of any significance in the past 12 months. Mr. Ray Vugrinovich (MDEQ) added that there have been no recent incidents in the Manistee area. Mr. Gary Butterfield (MDEQ) said he had not heard of any new complaints being reported. Mr. Don Masahowski (Michigan Public Service Commission) stated that there had not been any significant releases of hydrogen sulfide in the past 12 months.

Dr. Fischer stated that the Panel had been waiting for information regarding additional results of the CIIT study of hydrogen sulfide low level exposure. This was a chronic toxicity study where male rats were exposed six hours a day, seven days a week for 10 weeks. Concentrations used were zero, 10, 30, and 80 parts per million (ppm) (odor is noticeable at around one part per million). The only effects observed were nasal passage changes at exposures of 30 ppm or greater. At 80 ppm, 75 percent of the animals showed olfactory nerve loss. Models of rat nasal passages demonstrated the highest flux of gas in areas where the greatest damage was seen, correlating hydrogen sulfide exposure with injury. Extrapolation to humans would necessitate an interspecies safety factor of ten with an additional safety factor of ten because these studies used adult animals. This would go from a no effects level of 10 ppm to one of 0.1 ppm. There are difficulties in extrapolating the results to humans due to differences between the two species, with rats taking in all their air through the nasal passage as well as having olfactory nerves over a larger percentage of the surface area of these passages.

This study also tried to document residual levels of hydrogen sulfide in tissues, but was unable to find any increase above natural background levels. Hydrogen sulfide is also thought to link with heavy metals and disrupt the iron cycle in the body, including the iron-based enzyme cytochrome oxidase. However the CIIT study did not find any measurable changes in cytochrome oxidase. This seems to indicate that there was no systemic toxicity. The data from this study seem to be consistent with the figures quoted in the proposed Nebraska regulations. One of the difficulties encountered in Nebraska, as well as in Michigan, is the difficulty of monitoring at the very low levels that were proposed in the regulations. The exposure limits included 10 ppm for one minute and 0.1 ppm for a 30-minute average, with lower levels for 30-day averages. Instantaneous values were discarded as being impossible to accurately measure.

Dr. Fischer questioned the concentration of hydrogen sulfide detectable by smell. Dr. John Gracki noted this included a wide range of values, generally below one ppm. He then asked whether the major concern about ambient hydrogen sulfide levels was with constant sources or with intermittent accidents contributing to the background levels. Mr. Hal Fitch (MDEQ) replied that the MDEQ Geological Survey Division was concerned both with accident prevention and ambient air levels from ongoing routine operations. Information is readily available on the effects of acute levels for mandating accident response procedures; however, effects of the low-level ambient routine exposures are still in question. Mr. Fitch noted that the current rules prohibit nuisance odors, but the ambiguity regarding the levels of hydrogen sulfide which produce nuisance odors and whether there is an associated health impact needs to be clarified. Dr. Gracki added that data from Midland, Michigan suggested that odor complaints occurred at levels

much lower than those associated with health issues.

Dr. Fischer stated that the charge to the MESB was to provide a range of values that would be protective of human health, rather than recommending what the regulatory value should be. If the no effect level of 10 ppm, as found in the rat study, is used as the no effect level in terms of human health impact, then any regulation establishing a value below that level would necessarily need to be based on a DEQ risk management policy decision involving safety factors. He added that there has been some attempt to justify these factors, with humans being 10 times more sensitive to certain compounds. However, this is very chemical specific with some instances where animals are more sensitive than humans. The increased olfactory capability and sensitivity of rats to hydrogen sulfide could indicate either that the rats are more sensitive to, or more protected from, the long-term effects.

Dr. David Long noted that the rat study involved exposures of six hours a day, which had different implications from a 24-hour exposure. He stated that the human sense of smell was able to regenerate fairly quickly. This rejuvenation during unexposed times will alter the cumulative effect. Mr. Fitch commented that, although there has not been good documentation of the specific exposure levels, members of his staff had been exposed to hydrogen sulfide of perhaps 100 ppm, after which their olfactory nerves had appeared deadened, but subsequently recovered. Workers exposed to lower levels have been reported to lose their sense of smell during the course of a day, but then recovered it by the next morning.

Dr. Gracki questioned the capability of MDEQ equipment to routinely monitor hydrogen sulfide levels. Mr. Fitch responded that one ppm was the lowest level that usual equipment could detect. Monitors which record ambient levels at various sites in the state have consistently recorded levels of less than one ppm, but it is unknown how much lower. There are devices which reportedly measure less than hundreds parts per billion, but these instruments are not readily available. This would cause difficulties if a statute sets the safe level to be below that which is currently feasible to measure. If the human sense of smell is more sensitive than the monitors can routinely measure, odors or nuisance complaints could be used as a basis for assessing compliance. However, there is a variability of sensitivity as well as cases of phantom smells or odors caused by different compounds than the one being regulated.

IV. WRITING ASSIGNMENTS

Dr. Fischer stated that he would like to focus the health discussion on documentation of the limited data available on low level, long-term exposure. The emphasis should be on the lowest levels that have been seen to cause effects in either animals or humans with discussion of the exact levels and the specific effects that were seen. This would be combined with information on risk assessment methods for non cancer-causing chemicals. Measured health related values should be documented and the MDEQ allowed to apply safety factors, as it deemed necessary, although usual application of safety factors could be addressed.

Dr. Fischer noted that much of the available data has come from reports of complaints about problems that were subsequently repaired. Dr. Long stated that information from the surveys should be integrated into the data in the report and Dr. Gracki indicated that he would update the details of the Nebraska report. Mr. Harrison stated that he would incorporate all the various writing assignments into the report once he received them.

V. NEXT MEETING DATE

No additional meetings were scheduled.

VI. ADJOURNMENT

The meeting was adjourned at 10:58 a.m.

Keith G. Harrison, M.A., R.S., Cert. Ecol.
Executive Director
Michigan Environmental Science Board